Comment submitted to the Advisory Committee on
Measuring Innovation in the 21st Century Economy

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Along with Charles Hulten and Dan Sichel, I have done work that demonstrates the theoretical and practical significance of capitalizing business investment in intangibles in our national accounts (Corrado, Hulten, and Sichel 2005, 2006). The work has been well received in the research and policy-making communities, and I am often asked, "Why doesn't the federal government do more to move us in the direction you advocate?" The U.S. Bureau of Economic Analysis (BEA) made a very important move to capitalize software in 1999 (well before Hulten, Sichel, and I started working on intangibles), and the agency recently announced that it plans to treat expenditures on scientific R&D as investment in the core macroeconomic accounts beginning in 2012. If you believe, as I do, that macroeconomic data should treat business spending on *all* long-lived intangibles as investment, then further and faster progress is necessary.

Why does the capitalization of business intangible investments—spending by firms to develop new products, new processes, and new economic competencies—remain below the radar of statisticians and national accountants? And why must we wait until 2012 for scientific R&D to be treated as investment in our macroeconomic statistics? BEA's Director Steve Landefeld answers, "No one disagrees with [the capitalization of intangibles such as R&D] conceptually. The problem is in the empirical measurement."[1]

The main purpose of this comment is to suggest ways to address and remedy the statistical deficiencies in the available data on investment in intangibles. I also offer a related comment on measuring information and communication technology (ICT) activity and investment in the United States.

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* The views expressed in this comment are those of the author and do not necessarily reflect the views of the Board of Governors of the Federal Reserve System or other members of its staff.

1 Page 66 in Michael Mandel, "Unmasking the Economy," *Business Week* (February 13, 2006), pp 62-70.

Investment, Intangibles, and Innovation

An expanded view of investment is the key element of the Corrado, Hulten, and Sichel (CHS) work. Looking back to when we first started working and thinking about intangibles, it seems clear we were essentially engaged in a search for *aggregate* metrics of innovation. We thought there was more to productivity and innovation in the U.S. economy than investments in ICT and believed that economic theory supported a broader framework for thinking about capital and technology.

The average businessperson knows that innovation is a complex, gradual process, and that it often involves many firms *making incremental investments in a range of activities* over many years. This notion is at the heart of our work, namely, that investment in the innovation process involves many activities, *all of which should be part of the output and capital measures used to calculate total factor productivity*.[2] To implement the expanded view of investment and capital, we built on the work of many others and developed a framework for organizing and thinking about just what constitutes the *knowledge capital of the firm.*

As shown in table 1, the knowledge capital of the firm is viewed in three broad categories: (1) the knowledge embedded in computer programs and computerized databases; (2) the knowledge acquired through scientific R&D and other inventive and creative activities; and (3) the knowledge embedded in firm-specific human and structural resources, including brand names and "business models." CHS (2005) developed a list of seven asset types that fell in the second and third categories.

Business investments in innovative property were measured by indicators such as industrial R&D expenditures (a measure of the work done by scientists and engineers), mineral exploration costs, and proxies for expenditures on the discovery, design, and development of new products and services not built upon a scientific base of knowledge. Business investment in economic competencies were measured by expenditures on advertising, market and consumer research, employer-provided training, and managerial time devoted to innovation. The expanded CHS view of investment placed both a wider and deeper lens on the innovation process than does the conventional view of investment.

[2] By contrast, much—though certainly not all—of the empirical work on innovation takes measured output as given and tries to uncover the determinants of measured labor or multifactor productivity.

The expanded view is *wider* in that investments in innovative property consist of more than scientific R&D, that is, more than the innovative activity built on a scientific base of knowledge. Innovative property also consists of the discoveries and artistic content in commercial copyrights, licenses, and designs. The wider view thus encompasses investments in new products/processes by firms supplying financial services as well as entertainment and cultural products (that is firms that typically do not hire scientists and engineers). The wider view also encompasses expenditures on industrial design that are not included in scientific R&D. CHS referred to all these "wider" investments in innovative property as nonscientific R&D.

The expanded view of investment is *deeper* in that it treats the costs of the marketing and branding of new products as a *downstream* co-investment with the upstream R&D. Put differently, the average businessperson knows that R&D spending is an investment in the future capacity of the firm. He/she also knows that innovation goes beyond the *upstream* discovery of new inventions and technologies by scientists and engineers, beyond the creation of new ideas and designs by other workers, and beyond the turning of those inventions and ideas into new products and services. Inventions, ideas, new products, and new services are worthless without a *downstream* process that turns them into something that convinces people and firms to become customers.

A second way in which the expanded view is deeper is that it treats most expenditures devoted to improving the effectiveness of organizations—the investment by managers to adapt their organizations to embrace change and new technology—as investments in the future capacity of the firm. This is especially true for the spending that is associated with the adoption of information technology. Studies that have looked at the relationship between a firm's investment in ICT hardware and its productivity have found that large co-investments—outlays on worker training and of managerial time—usually accompanied successful changes to business processes.[3]

[3] For a summary of some of this work, see "Remarks" by Erik Brynolfsson and Lorin Hitt, p. 567-575, in *Measuring Capital and Technology*, ed, Corrado, Haltiwanger, and Sichel (2005). In the data analyzed by Brynolfsson and Hitt, the *direct* spending on business process redesign and employing training greatly dwarfed the spending on the new hardware and software. The research of Bloom and Van Reenan (2006) and of Amar Bhibe (2006) also supports the treatment of such downstream spending as business investment.

Measuring Intangible Investment: New Surveys Needed

The most important empirical deficiency is the paucity of official survey-based measures of intangible investments. Although CHS used the available survey data and otherwise assembled estimates in the fashion of empirical researchers, official survey-based measures for *all intangible asset types* are needed for the capitalization of intangibles in the national accounts. Price indexes and depreciation rates by each asset type also are needed as noted briefly below.

Survey-based measures of scientific R&D spending are already being collected in a survey that is managed and funded by the National Science Foundation. Although it seems natural for the NSF to continue to focus on science and engineering, the NSF's program could be leveraged to collect more information under the broader agenda of measuring innovation. To remedy the gap in the empirical measurement of investment in innovative property:

- The Census Bureau should institute **a new annual survey that collects business spending on the design and development of new products and new processes** (*except* that spent on work done by scientists and engineers).

The new instrument should be patterned after the NSF's scientific R&D survey, but it would yield different, complementary data: It would yield the spending on other industrial design and the spending to design and develop new financial, entertainment, cultural, or other products. Although CSH referred to this spending as nonscientific R&D, for purposes of this survey, the activity to be measured is better termed design and development (rather than research and development).

The empirical measurement of investments in economic competencies also contains major gaps, and here, too, it is possible to build upon an existing instrument, the Survey of Employer-Provided Training (EPT). The EPT was designed by the Bureau of Labor Statistics and conducted once in the mid-1990s. This survey yielded highly relevant information that, like the data from the NSF's R&D survey, was consistent with and inserted directly in the CHS framework.

- The BLS EPT should be updated and conducted annually. Moreover, **the EPT should be broadened to cover employer investments in structural resources as well as employer investments in human resources.**

In addition to data on employer-provided training, the additional information collected in the new, broadened survey would be the cost of management time devoted to enhancing the productivity of the firm – or what is nearly equivalent, firms' expenditures on strategic planning and on restructuring and adapting its structural resources to use new technologies or new competitive strategies.

In conjunction with the proposal for two, ongoing, annual surveys, more research on measuring intangibles is needed. The final proposal is:

- The Commerce Department should make available funds to **conduct research on the best ways to fill the remaining gaps in the current and historical empirical measures of intangibles.** These gaps include (but are not limited to) the following:
    - Research the extent to which existing data collected by the Census Bureau could be used to measure investments in the marketing and branding of products (new and existing). Can questions be added to the Business Expenses Survey? Can questions be added to the NSF and new innovation survey to collect the co-investments with upstream R&D?
    - Determine the best way to collect measures of own-account commercial social science R&D, a separate asset type within the innovative property category. Should it be included in the new survey or added to the NSF's R&D survey?
    - Conduct/sponsor research to further develop historical estimates of intangible investments.
        - A priority is to develop better estimates of employer-provided training.
        - A cross-country examination may yield insights for the estimation of missing data.
    - Conduct/sponsor research on estimating the depreciation of intangible assets. Past research on the depreciation of R&D should be updated.
    - Conduct/sponsor research on methods that could be used to determine asset-specific price indexes for intangible investments.

Innovation and the U.S. ICT Sector: Need to Correct an Anomaly

When talking about economic statistics, Federal Reserve Governor Randall Kroszner introduced the theme: An innovative economy needs innovative statistics.[4] The nation's ICT producing firms are among the most innovative firms in the world, and it is vital that our statistics adapt so that economic activity in the ICT sector is captured accurately and transparently. However, the measurement of ICT and other more dynamic parts of the economy is being distorted by what seems to be anomalies in the industry (NAICS) classifications of certain types of firms.

There is no single model for accelerating innovation and productivity in a firm. But the distribution of economic functions—innovation, component and industrial design, manufacturing, and marketing—among many different players in a supply chain has been a common strategy used by the firms that create and supply ICT products. As firms headquartered in the United States have globalized, often they have located their production facilities abroad while maintaining their R&D, marketing, and merchandising facilities here. Meanwhile "fabless" semiconductor companies—companies who contract for the production of their designs by separately-owned foundries often located in Taiwan—have grown very rapidly in the United States.

The anomaly is that our statistical system will classify the "fabless" chip makers, along with the tech companies who no longer own domestic production facilities in the United States, in the wholesale trade sector. Think about it. The statistical system has reduced companies that design and create ICT products—companies that include some of the world's greatest innovators such as Apple, Nvidia, and Cisco—to resellers of imported goods.[5] In our analytical work on productivity at the Federal Reserve, we have found it useful to follow developments in the ICT sector in order to understand productivity developments in the aggregate U.S. economy. The anomaly makes the job of identifying and measuring ICT productivity especially difficult.

The anomaly is also problematic for studying patterns in the industrial composition of R&D. However, the National Science Foundation (NSF), the agency that issues the R&D data, recently released the results of research that it did to be sure that

[4] See Governor Randall S. Kroszner**,** *Innovative Statistics for a Dynamic Economy*, May 24, 2006. Available at http://www.federalreserve.gov/boarddocs/speeches/2006/20060524/default.htm.
[5] Michael Mandel (2006) has made a similar point.

companies were consistently classified for the purposes of analyzing trends in R&D. They found that nearly $40 billion of R&D spending (about 20 percent of total R&D spending) was incorrectly classified in wholesale trade in 2004 and have issued corrected data. The corrected data were based on **classifying companies according to their primary business activity based on their consolidated operations** rather than their primary activity in the United States. The NSF's revised classification treats the modularity in globalized production systems—and thus R&D—consistently across firms.

The Census Bureau, which conducts the R&D survey for the NSF, currently classifies companies according to their primary activity in the United States. For the study of innovation and productivity, the Census Bureau should develop comprehensive activity measures for the nation's most innovative sectors following the approach to classification developed by the NSF. The revised approach would need to be the basis for the classification used in the proposed new surveys if the data were to used for sectoral or industry productivity analysis.[6]

Conclusion

Data on economic activity and productivity derived from our national accounts are key inputs to the everyday decisions made by policymakers and by businesses. The CHS framework is based on a view of investment that is grounded in economic theory and strikingly consistent with business reality. The message is clear: Business expenditures on long-lived intangibles should be capitalized in our national accounts.

Four suggestions have been offered to remedy Landefeld's "problem in the empirical measurement" of intangibles: (1) Institute a new survey to collect spending on the new product/process design and development activities that are not captured by the NSF's survey; (2) Update and broaden the BLS employer-provided training survey to cover the cost of management time devoted to enhancing the productivity of the firm; (3) Conduct and/or sponsor research whose main priorities are to fill remaining gaps in the ongoing measurement of intangible investment and to strengthen the available historical

[6] Another issue is that the Census Bureau and the BLS do not use the same business register, which further complicates sectoral and industry productivity analysis. See Krozsner (2006) and a recent report of the Committee on National Statistics of the National Academies (2006) for further elaboration.

estimates of intangible investment and capital; and (4) Update our classification system to treat the modularity in production systems consistently across firms.

If the Measuring Innovation in the 21st Century Economy Advisory Committee were to implement these suggestions, our macroeconomic statistics would contain aggregate metrics of upstream and downstream investments in innovation, and our productivity statistics would be correspondingly improved. Of course, an especially important challenge in the measurement of productivity is that price statistics accurately reflect the advances in technology that have occurred. Moving to adopt an expanded view of investment that includes intangibles not only modernizes the portrayal of business activity and innovation in measures of economic activity, it underscores the ongoing need to have accurate price measures of the most dynamic sectors and industries of the economy.

Table 1
Business Intangibles by Broad Group

NAME OF GROUP	TYPE OF KNOWLEDGE CAPITAL	CURRENT STATUS IN THE U.S. NIPAS
Computerized information	Knowledge embedded in computer programs and computerized databases.	The major component, computer software, is capitalized.
Innovative property	Knowledge acquired through scientific R&D and nonscientific inventive and creative activities.	Most spending for new discovery, design and development is expensed.[1]
Economic competencies	Knowledge embedded in firm-specific human and structural resources, including brand names.	No items recognized as assets of the firm.

1. The BEA plans to fully capitalize scientific R&D, a major component of innovative property, in the core NIPAs by 2012. Two smaller components, oil and gas exploration and architectural and engineering services embedded in equipment purchases, are already included in NIPA business fixed investment. See Corrado, Hulten, and Sichel (2005).